

Remarks

Reconsideration of this application as amended is respectfully requested.

Claims 18-34 stand rejected under 35 U.S.C. §112, first paragraph.

Claims 18-34 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,146,410 of Kawamura et al. ("Kawamura") and U.S. Patent No. 5,566,180 of Eidson et al. ("Eidson").

Claims 18-34 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kawamura and Eidson and U.S. Patent No. 4,514,814 of Evans ("Evans").

New claims 35-37 have been added.

The Examiner has rejected claims 18-34 under 35 U.S.C. §112, first paragraph, and has stated that the "independently" limitation is not supported in applicants specification. Applicant has amended claims 18, 23, and 27 to remove the "independently" limitation.

The Examiner has rejected claims 18-34 under 35 U.S.C. §103(a) as being unpatentable over Kawamura and Eidson and Evans. Applicant respectfully submits that amended claim 18 is not obvious in view of Kawamura and Eidson and Evans. Amended claim 18 is a motion control system that includes a set of control nodes each for controlling a single axis of the motion control system. Kawamura and Eidson and Evans do not disclose or suggest a control node for a single axis as claimed in amended claim 18.

Kawamura discloses a control apparatus 20 for controlling three axes of a motion control system together (Kawamura, col. 2, line 21) rather than a control node for a single axis as claimed in amended claim 18. Kawamura clearly states that

A programmable machine controller (PMC) 10 is coupled to a computerized numerical control (CNC)

apparatus 20 and issues command signals for controlling three axes of the CNC apparatus 20. (*Kawamura*, col. 2, lines 18-21) (emphasis added). It is further submitted that this type of wasteful grouping of control hardware for multiple axes as taught by *Kawamura* is one of the shortcomings of the prior art that applicant's invention seeks to remedy. (See page 3-4 of applicant's specification).

Eidson does not disclose control nodes each for controlling a single axis of a motion control system as claimed in amended claim 18.

Evans discloses a set of axis boards (Fig. 1 of *Evans*) each for controlling multiple axes (*Evans*, col. 3, lines 1-6) rather than control nodes each for controlling a single axis as claimed in amended claim 18. Figure 3B of *Evans* shows a set of three axis control computers and a set of three servo interfaces on one axis board. It is submitted that the type of wasteful grouping of control hardware on axis boards as taught by *Evans* is one of the shortcomings of the prior art that applicant's invention seeks to remedy. (See page 3-4 of applicant's specification).

In further contrast, the application of the control values to the axes of the motion control system of amended claim 18 is coordinated using trigger times and synchronized clocks. *Kawamura* and *Eidson* and *Evans* do not disclose or suggest coordinating the application of control values to axes of a motion control system using trigger times and synchronized clocks as claimed in amended claim 18.

Kawamura teaches that movement is triggered by the transfer of grouping information from the PMC 10 to the CNC apparatus 20 rather than using trigger times and synchronized clocks as claimed in amended claim 18. For example, *Kawamura* discloses

means for starting to distribute pulses to axes when

all commands for the axes in the respective groups are received by the computerized numerical control apparatus.

(*Kawamura*, col. 1, lines 59-62) (emphasis added) and then explicitly states that

The axes in the groups are caused to start simultaneously moving in response to the information with respect to the grouping of the axes sent from the programmable machine controller.

(*Kawamura*, col. 1, lines 65-68) (emphasis added).

It is submitted that the execution times taught by *Kawamura* are not trigger times for control values as claimed in amended claim 18. Instead, the execution times taught by *Kawamura* are time intervals for performing linear interpolation of commanded motions. (*Kawamura*, col. 1, lines 41-47). For example, *Kawamura* discloses means for starting to distribute pulses to axes when all commands for the axes in the respective groups are received by the computerized numerical control apparatus, and for distributing the pulses within the execution times to effect linear interpolation with respect to the axes.

(*Kawamura*, col. 1, lines 59-64) (emphasis added) and states that

since the second and third axes of the group B execute commanded motions during the given time T_e , linear interpolation is effected...

(*Kawamura*, col. 2, lines 37-40) (emphasis added).

Eidson and *Evans* do not disclose or suggest the limitations of amended claim 18 of coordinating the application of the control values to multiple axes of a motion control system using trigger times and synchronized clocks.

It is further submitted that *Kawamura* and *Evans* do not teach or suggest a combination with *Eidson* and that *Eidson* does not teach or suggest a combination with *Kawamura* and *Evans*. It would be impermissible hindsight based on an applicant's own disclosure to incorporate the clock synchronization of *Eidson* into the control apparatus of *Kawamura* or the motion control system of

Evans. Moreover, any such combination would still lack the limitations of control nodes that each control a single axis of a motion control system and coordinating the application of control values using trigger times as claimed in amended claim 18.

Given that claims 19-22 depend from amended claim 18, it is submitted that claims 19-22 are not obvious in view of the references cited by the Examiner.

It is also submitted that amended claim 23 is not obvious in view of the references cited by the Examiner.

Amended claim 23 includes limitations similar to the limitations of amended claim 18 including control nodes for controlling a single axis and coordinating the application of the control values to the axes using trigger times and synchronized clocks. Therefore, the remarks stated above with respect to amended claim 18 also apply to amended claim 23.

Moreover, amended claim 23 includes the additional limitations of tables that hold pre-computed control values and trigger times for multiple motion control functions and a selector node that specifies an appropriate motion control function for each axis of control.

Given that claims 24-26 depend from amended claim 23, it is submitted that claims 24-26 are not obvious in view of the references cited by the Examiner.

Applicant further submits that amended claim 27 is not obvious in view of the references cited by the Examiner. Amended claim 27 is a method for controlling a set of axes of a motion control system in which the application of control values to the axes is coordinated using trigger times that are associated to control values. *Kawamura* and *Eidson* and *Evans* do not teach or suggest that control values are applied to axes in response to trigger times as claimed in amended claim 27.

Instead, Kawamura teaches that movement is triggered by the transfer of grouping information to a control apparatus. (Kawamura, col. 1, lines 59-62).

Given that claims 28-34 depend from amended claim 27, it is submitted that claims 28-34 are not obvious in view of the references cited by the Examiner.

It is further submitted that new claim 35 is not obvious in view of the references cited by the Examiner. New claim 35 is a motion control system that triggers the motions of a first and a second axis at substantially the same time by setting the trigger times in the control nodes for the first and second axes equal to a starting time. Kawamura and Eidson and Evans do not teach or suggest that motions of multiple axes may be triggered at the same time using trigger times as claimed in new claim 35. Instead, Kawamura teaches that movement is triggered by the transfer of grouping information to a control apparatus. (Kawamura, col. 1, lines 59-62).

Given that new claims 36-37 depend from new claim 35, it is submitted that new claims 36-37 are not obvious in view of the references cited by the Examiner.

It is respectfully submitted that in view of the amendments and arguments set forth above, the applicable objections and rejections have been overcome.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 50-1078 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

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By:


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